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ABSTRACT

The use of meta-analysis in industrial and organizational psychology has become quite common. Unfortunately, the understanding and research necessary to ensure appropriate application of the technique have not been as widespread. As part of a larger study, a content analysis of meta-analyses from the industrial and organizational psychological literature was conducted to document the sample sizes--(sub i), number of studies (K), reliabilities: $r(\text{sub } xx)$, $r(\text{sub } yy)$; and types of meta-analyses occurring in the literature. This content analysis was used to identify the typical values associated with data sets found in meta-analyses conducted in industrial and organizational psychology. Published articles occurring from January 1980 to June 1986 in seven journals were included. Meta-analytic papers presented at the 1984 and 1985 annual meetings of the American Psychological Association and the Academy of Management were also reviewed. A total of 81 meta-analytic studies was found; 19 were selection validation and 62 were non-validation studies. Results of the content analysis included the average reported reliabilities ($R(\text{sub } xx) = 0.79$, and $R(\text{sub } yy) = 0.71$) and the median sample size per correlation-- $n(\text{sub } i) = 102$. Together, these two findings indicate that the literature is full of studies having low power, and that based on other research (J. M. Cornwell, 1987; E. R. Kemery, K. W. Mossholder, and L. Roth, 1987; and R. T. Ladd and J. M. Cornwell, 1986), such data may lead to biased estimates when used in a meta-analysis. Four tables and two graphs present study data. (Author/SLD)

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Content Analysis of Meta-Analytic Studies from I/O Psychology

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ABSTRACT

Content Analysis of Meta-Analytic Studies from I/O Psychology

The use of Meta-Analysis in industrial and organizational psychology has become quite common. Unfortunately, the understanding and research necessary to ensure appropriate application of the technique has not been as widespread. As part of a larger study a content analysis of meta-analyses from the industrial and organizational psychological literature was conducted to document the sample sizes (n_i), number of studies (K), reliabilities (r_{xx} , r_{yy}), and types of meta-analyses occurring in the literature. This content analysis was used to identify the typical values associated with data sets found in meta-analyses conducted in industrial and organizational psychology. Results of the content analysis included the average reported reliabilities ($R_{xx} = .79$, $R_{yy} = .71$) and the median sample size per correlation ($n_i = 102$). Together, these two findings indicate that the literature is full of studies having low power and that based on other research (Cornwell, 1987; Kemery, Mossholder, & Roth, 1987; Ladd & Cornwell, 1986) such data may lead to biased estimates when used in a meta-analysis.

Content Analysis of Meta-Analytic Studies from I/O Psychology

The use of Meta-Analysis in industrial and organizational psychology has become quite common (Loschenkohl, Faust, Lowenberg, & Conrad, 1984; Schmidt, 1984). Unfortunately, the understanding and research necessary to ensure appropriate application of the technique has not been as widespread (Kraemer, 1983). Evidence suggests that using meta-analytic techniques with data sets having small n 's and low reliabilities will result in biased estimates (Cornwell, 1987; Kemery, Mossholder, & Roth, 1987; Ladd & Cornwell, 1986).

Method

As part of a larger study a content analysis of meta-analyses from the industrial and organizational psychological literature was conducted to determine the types of data being included in meta-analytic studies. This review included published articles occurring from January, 1980 until June, 1986 from the following journals:

1. *Psychological Bulletin*
2. *Journal of Applied Psychology*
3. *Personnel Psychology*
4. *American Psychologist*
5. *The Academy of Management Review*
6. *Academy of Management Journal*
7. *Organizational Behavior and Human Decision Processes*
(formerly *Organizational Behavior and Human Performance*)

Meta-analytic papers presented at the 1984 and 1985 annual meetings of the American Psychological Association and the Academy of Management were also reviewed.

The content analysis of the characteristics of the discovered studies reporting meta-analytic results provided information about the sample sizes (n_i), the reliabilities (r_{xx} and r_{yy}), the number of correlations included in a meta-analysis (K), and the meta-analytic procedure used (e.g., Glass, McGaw, & Smith, 1981; Hedges, & Olkin, 1985; and Hunter, Schmidt, & Jackson, 1982). The abstracts of every article in the seven

journals were read to identify meta-analytic studies. The programs of the annual meetings were read to identify by title presentations having meta-analysis results. These papers were solicited from their authors through letters mailed before and after the annual meetings.

Only articles and papers from the above sources that actually reported meta-analytic results were included in this review. All purely methodological and theoretical papers with no results from a meta-analysis were excluded. No attempt was made to remove non-industrial/organizational meta-analyses from the review if the analysis came from the above mentioned sources. Selection validation meta-analyses were grouped separately from non-validation meta-analyses to permit comparing the the types of data sets used in each group. The author believed that validation meta-analyses would tend to have more correlations per meta-analysis (i.e., K) and larger sample sizes per correlation (i.e., n_i).

Results

A total of 81 meta-analytic studies was discovered in the review of the seven journals and two years of convention presentations. Table 1 presents the frequency of meta-analytic studies by source and whether or not the content concerned selection validation. Almost one-fourth of the 81 studies were meta-analyses of selection validation studies.

Insert Table 1 about here

The frequency of the use of the various meta-analytic procedures was determined by analyzing the citations associated with the meta-analyses. The procedure most often used is the one advocated by Hunter et al. (1982). It was used with all but one of the validation meta-analytic studies and almost half of the non-validation studies. Table 2

presents the breakdown of meta-analytic procedure and content. Because three of the articles reported more than one type of meta-analysis the totals in Table 2 are larger than those in Table 1. Also, because the procedures have appeared in many articles and books, the citation is not necessarily the actual one used by the authors of the meta-analytic study.

Insert Table 2 about here

The content analysis of the meta-analyses found in the literature permitted the construction of distributions of the discovered sample sizes (n_i) and the discovered number of correlations used in a single meta-analytic calculation (K) for both validity and non-validity studies. Table 3 gives the descriptive statistics for the n_i and K distributions. While the means and variances of the nonvalidity and validity meta-analyses appear to differ greatly, in actuality the shapes of the n_i and K distributions of the two groups of studies are very similar. Extreme values, as measured by positive skewness values in Table 3, contribute to the large differences between the means and variances.

Insert Table 3 about here

The shapes of the truncated combined distributions for n_i and K are shown in Figures 1 and 2, respectively. The sample size distributions were truncated so that $n_i \leq 500$ for purposes of graphically presenting the distribution. This resulted in the loss of less than nine percent of the observations for the combined distribution which were asymptotically distributed near zero percent. Similarly, the distributions of K 's were

truncated at $K \leq 120$. This truncation resulted in a loss of less than six percent of the observed K 's.

Insert Figures 1 and 2 about here

The average reliabilities for the predictor and the criterion (i.e., independent and dependent variables) for each of the meta-analytic studies were also abstracted. Twelve estimates for the predictor reliability (r_{xx}) and fourteen estimates for the criterion reliability (r_{yy}) were discovered. Table 4 presents the mean reliabilities by content and the number of individual estimates contributing to each mean. The mean reliabilities for the combined studies were $\bar{r}_{xx} = .79$ and $\bar{r}_{yy} = .71$.

Insert Table 4 about here

In the majority of the meta-analyses the authors were either unable or unwilling to publish information concerning the reliabilities associated with the effect sizes under investigation. Of the 19 selection validation studies less than half provided any reliability information. All eleven reliabilities listed in Table 4 for validation studies came from only eight of the 19 meta-analytic studies. The nonvalidity studies were even less informative when it came to reporting reliabilities. Only seven of the 62 nonvalidity meta-analytic studies contained any reliability information. In some cases the authors reported that the reliabilities were not available from the original studies. In other cases such information was available but the authors did not report the estimates. Some authors did not report the reliabilities even though they used the estimates in correcting for attenuation.

Discussion

The typical conditions found in meta-analytic studies from the industrial and organizational psychological area were reported in the results. Not surprisingly the most often used procedure among the meta-analyses reviewed was that of Hunter et al. (1982). This procedure was developed by Hunter and his associates to reconcile conflicting validation study results within the domain of industrial and organizational psychology. It is no wonder that it has predominance in this literature and is virtually the only procedure used with validity correlation coefficients.

A surprising finding is the similarities between characteristics of validity and nonvalidity meta-analytic studies. The distributions of n_i and K for each type of study are remarkably similar. The median sample size per correlation for the validity distribution ($n_{\text{median}} = 116$) and the nonvalidity distribution ($n_{\text{median}} = 99.5$) do not differ greatly. The two types of studies are also similar in the median number of correlations analyzed (i.e., $K_{\text{median}} = 14$ for validation versus $K_{\text{median}} = 11$ for nonvalidation). The small differences that do exist are in the direction that is supportive of the author's conjecture, that is, the meta-analyses of validity coefficients would have larger n_i 's and have more studies to accumulate. However, these differences are trivial. Another similarity between the validation and nonvalidation studies is their average reliabilities. Because only fifteen of the 81 meta-analyses that were reviewed reported reliabilities, the results may not generalize to the other studies. However, the predictor mean reliabilities ($\bar{r}_{xx}$) differ only by .01 and the criterion mean reliabilities ($\bar{r}_{yy}$) differ by .052 for the validation and nonvalidation meta-analyses, with the validation studies having the higher average reliabilities for both predictor and criterion.

The characteristics of the validation and nonvalidation studies reveal much about the research that has been occurring in industrial and organizational psychology. The median sample size per correlation as represented in the combined meta-analytic studies

is 102. If we use this value as representative of the sample size typically found in industrial and organizational psychology we can determine what the typical power is by making a few reasonable, additional assumptions. Using Cohen's (1977) power analysis and assuming $n_i = 100$, $\alpha = .05$, $\rho = .25$, and perfectly reliable data, the calculated theoretical power to reject the null hypothesis is slightly more than 50%. Thus almost half of the studies represented in the content analysis would have a Type II error of approximately 50% assuming they used $\alpha = .05$, and the true effect size was $\rho = .25$ and "perfect" data sets with no unreliability or range restriction.

The other major problem that comes to light is the low mean reliabilities of the variables being used in correlational and experimental research. Average reliabilities of .79 and .71 definitely mean that the estimated effect sizes and therefore the power of the research represented is attenuated. Obviously, to the extent that these findings are representative, small sample research with its associated problems of low power fill the industrial and organizational psychological literature.

The greatest problem is in using the data in meta-analytic studies. There has been ample Monte Carlo simulation research conducted on meta-analytic techniques to indicate that use of effect sizes based on small samples and unreliable data (the typical data found in this study) will produce biased and unreliable estimates of population effect sizes and variances (Cornwell, 1987; Kemery, Mossholder, & Roth, 1987; Ladd & Cornwell, 1986). These findings cast doubt on the validity of the meta-analyses that were reviewed in this study.

In summary, an abundance of n_i 's smaller than 100 and mean reliabilities less than .80 sums up the condition of research within industrial and organizational psychology as represented by the studies included in the 81 meta-analyses reviewed. These studies were also negligent in reporting information concerning reliabilities and the degree of range restriction present with the sample used. While several authors

bemoaned the lack of such information in the original studies, other authors of meta-analytic studies had access to but did not report such information. While it may be understandable that the original researcher did not include reliabilities because of ignorance, it is certainly not the case with the author of a meta-analytic study who should appreciate the importance of such information. Finally, the actual validity of the meta-analyses reviewed may be questioned based upon the quality of the data sets typically used (i.e., small sample sizes, unreliable data).

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Table 1

Frequency of Meta-Analytic Studies by Literature Source and by Content

	Industrial/Organizational Psychological Literature Sources Reviewed ^a	Validation Studies	Nonvalidation Studies	Total Studies
1.	Psychological Bulletin	1	24	25
2.	Journal of Applied Psychology	7	10	17
3.	Personnel Psychology	6	2	8
4.	American Psychologist	0	3	3
5.	Academy of Management Review	0	5	5
6.	Academy of Management Journal	0	4	4
7.	Organizational Behavior and Human Decision Processes (formerly Organizational Behavior and Human Performance)	0	2	2
8.	1984 and 1985 APA Presentations	4	6	10
9.	1984 and 1985 Academy of Management Presentations	1	6	7
	Totals	19	62	81

^a Meta-analytic journal articles published between January, 1980 and June, 1986 are included. A listing of these references is available from the author.

Table 2

Frequency of Meta-Analytic Studies by Meta-Analytic Procedure and Content

	Meta-analytic Procedure Used (indicated by the citation given for the procedure)	Validation Studies	Nonvalidation Studies	Total
1.	Hunter et al. (1982)	18	30	48
2.	Glass et al. (1981)	0	13	13
3.	Hedges et al. (1985)	0	5	5
4.	Rosenthal (1984)	0	8	8
5.	Miscellaneous (Z-test, summing probability levels, voting method)	1	9	10
	Totals	19	65	84

Table 3

Descriptive Statistics for the Distributions of Sample Size (n_i) and Number of Correlations included in a Meta-Analysis Calculation (K) by Content

Descriptive Statistic	Sample Size (n_i)			Number of Correlations Used (K)		
	Selection Validation	Non validation	Combined	Selection Validation	Non validation	Combined
Number of Observations ^a	695	1802	2497	323	302	625
Mean	301.39	275.61	282.78	55.2	17.5	37.01
Median	116	99.5	102	14	11	12
Mode	100	73	73	10	6	6
Standard Deviation	576.05	1680.69	1459.66	155	26.6	114.43
Variance	331,837	2,824,726	2,130,593	24,024	709.4	13,093.7
Skewness	5.27	22.7	25.07	9.00	7.50	11.99
Kurtosis	34.67	579.54	734.91	109.55	74.73	198.67
Minimum	7	10	7	2	2	2
Maximum	5,635	45,222	45,222	2,162	330	2,162

^aNumber of observations refers to the total number of correlation sample sizes (n_i) actually reported in all the articles reviewed or, for the second column, to the total number of individually calculated meta-analyses reported for which K could be determined (many articles reported calculating multiple meta-analyses using subsets of the correlations).

Table 4

Mean Reliabilities of Predictor ($\bar{r}_{xx}$) and Criterion ($\bar{r}_{yy}$) and the Number of Observations for Each by Content of Study

Content	$\bar{r}_{xx}$	n	$\bar{r}_{yy}$	n
Nonvalidation Studies	.786	7	.692	8
Selection Validation Studies	.796	5	.744	6
Combined Studies	.790	12	.714	14

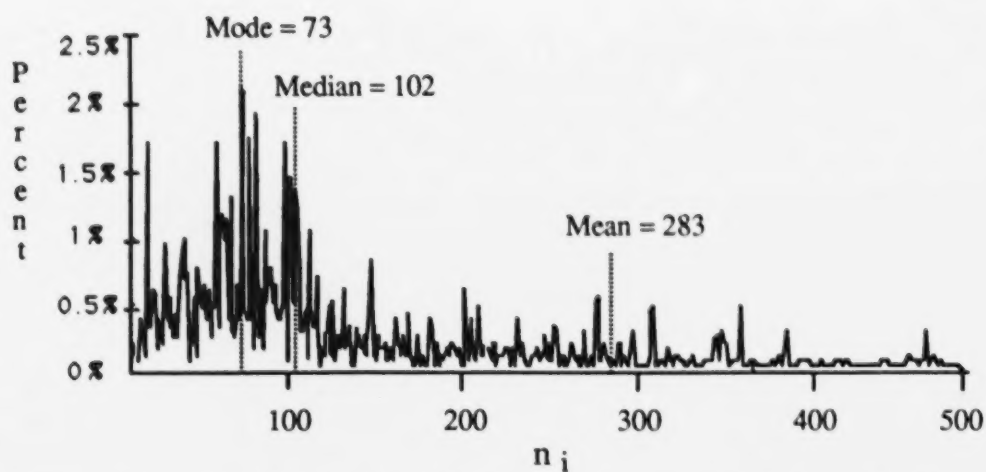


Figure 1 The truncated distribution of sample sizes (n_i) per correlation coefficient.

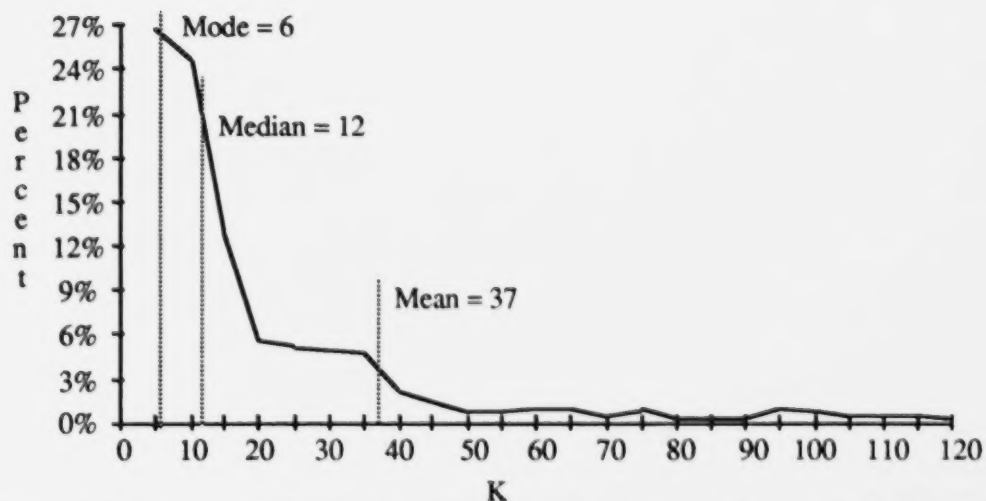


Figure 2 The truncated distribution of K , the number of correlation coefficients included per meta-analysis.